What is claimed is:

1. A catheter comprising:

an elongate catheter body,

a cooling chamber defined within the catheter body,

an expandable member disposed around the cooling chamber.

2. The catheter of claim 1, wherein the expandable member envelops the cooling chamber.

3. The catheter of claim 1, wherein the expandable member is disposed around the cooling chamber to define an interstitial space therebetween.

4. The catheter of claim 3, wherein the interstitial space is in fluid communication with a source of fluid evacuation.

5. The catheter of claim 3, wherein the cooling chamber is a first expandable membrane inflatable from a first state to a second state.

6. The catheter of claim 5, wherein the catheter body further comprises a coolant injection tube in fluid communication with:

(i) a source of coolant, and

(ii) the cooling chamber,

and wherein the cooling chamber is inflatable by the flow of coolant from the injection tube into the first expandable membrane.

7. The catheter of claim 6, wherein the catheter body further comprises a primary coolant return lumen in fluid communication with:

(i) a source of fluid evacuation, and

(ii) the cooling chamber,

and wherein the coolant injection tube, the cooling chamber, and the primary coolant return lumen define a first fluid pathway for the flow of coolant.

8. The catheter of claim 7, wherein the catheter body further comprises a secondary coolant return lumen in fluid communication with:

(i) a source of fluid evacuation, and

(ii) the interstitial space,

and wherein the interstitial space and the secondary coolant return lumen define a second fluid pathway for the flow of coolant.

9. The catheter of claim 3, wherein the cooling chamber has an outer surface and the expandable member has an inner surface, said surfaces being substantially in apposition to one another to define a first volume of the interstitial space.

10. The catheter of claim 9, wherein at least one of

(i) the inner surface of the expandable member, and

(ii) the outer surface of the cooling chamber,

is topographically non-uniform.

4 3
~~11.~~ The catheter of claim ~~10~~, wherein at least one of

(i) the inner surface of the expandable member, and

(ii) the outer surface of the cooling chamber,

is patterned to enhance the flow capacity of fluid flow in the interstitial space.

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~~12.~~ The catheter of claim ~~10~~, wherein at least one of

(i) the inner surface of the expandable member, and

(ii) the outer surface of the cooling chamber,

is in part formed using plasma treatment.

6 3
~~13.~~ The catheter of claim ~~10~~, wherein at least one of

(i) the inner surface of the expandable member, and

(ii) the outer surface of the cooling chamber,

is in part formed using vapor deposition of additional material onto said surface.

7 3
~~14.~~ The catheter of claim ~~10~~, wherein at least one of

(i) the inner surface of the expandable member, and

(ii) the outer surface of the cooling chamber,

is in part comprised of a plurality of partially raised surfaces arranged on said surface.

8 1
~~15.~~ The catheter of claim ~~8~~, further comprising a plurality of small particles disposed in the interstitial space.

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~~16.~~ The catheter of claim 3, further comprising a flexible structure disposed within the interstitial space and around the cooling chamber.

17. The catheter of claim 16, wherein the flexible structure comprises at least one flexible elongate element wound in a first direction of rotation around the cooling chamber.

18. The catheter of claim 16, wherein the flexible structure further comprises at least one flexible elongate element wound in a second direction of rotation around the cooling chamber.

19. The catheter of claim 17, wherein the flexible elongate structure has a cross-sectional thickness in the range of 0.001 to 0.01 inches.

20. The catheter of claim 1, further comprising at least one temperature sensor disposed within the cooling chamber.

21. The catheter of claim 1, further comprising at least one pressure sensor disposed with the cooling chamber.

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~~22~~. A catheter comprising:

a handle in fluid communication with

a supply of cooling fluid having a boiling temperature, and

a source of fluid evacuation,

a cooling chamber having fluid impermeable inner and outer surfaces,

an elongate catheter body having

a coolant injection lumen having proximal and distal end portions, the proximal end portion being in fluid communication with the supply of cooling fluid, the distal end portion being in fluid communication with the cooling chamber, and

a primary return lumen having proximal and distal end portions, the proximal end portion being in fluid communication with the source of vacuum, the distal end portion being in fluid communication with the cooling chamber,

an expandable member having inner and outer surfaces coupled around said cooling chamber, wherein a space exists between the cooling chamber outer surface and the expandable member inner surface, and

a secondary return lumen disposed within the catheter body, having proximal and distal end portions, the proximal end portion being in fluid communication with the source of vacuum, the distal end portion being in fluid communication with the space.

16 15

~~23~~. The catheter of claim ~~22~~, wherein the cooling chamber is controllably filled with cooling fluid, and vacuum is applied to the primary return lumen to direct the cooling fluid to flow from the cooling chamber through to the primary return lumen.

17 16
24. The catheter of claim 23, wherein the outer surface of the expandable member is disposed in contact with tissue proximate a body lumen to effect thermal conduction between said tissue and the flow of cooling fluid in the cooling chamber.

18 16
25. The catheter of claim 23, wherein vacuum is applied to the secondary return lumen.

19 15
26. The catheter of claim 22, wherein the cooling chamber is an inflatable membrane transitionable from a first volume to a second volume, the second volume being larger than the first volume.